Staff summary

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Highway-Railroad Crossing Safety

An In-house study by Organizational Results
in cooperation with the Multimodal Operations Division

MoDOT Project Overview

Improving safety at highway-railroad crossings is a prime concern for MoDOT's Railroad Section. The Railroad section requested a search of current literature on the following topics:

1. The use of LED bulbs instead of incandescent bulbs at highway-railroad crossings and how they are better seen, safer, etc. (a study on the use of LED bulbs for ordinary traffic lights was acceptable).
2. The impact that an immediate right turn across a highway-railroad crossing with no active warning devices from a road that parallels a railroad track. The most accidents that occur at highway-railroad crossings are those in which the driver makes a turn immediately before going across the track, usually to the right.
3. The likelihood of a higher probability of being killed in a train/vehicle crossing crash if you are hit by a train and are unbelted?

Organizational Results' staff conducted a literature search on each of these topics. There was a limited amount of research available on the first two topics. Following an exhaustive search on the third topic, it was determined there is no solid research available to support that topic.

MoDOT Staff Findings

For the first two topics, a brief summary and a link to the web site containing the full text of the documents are provided.

Item #1 – LED bulbs at railroad crossings

MoDOT study – LED Signal Installation (2000)

Summary: Red, green and yellow light emitting diode (LED) signals were compared to incandescent bulbs of the same color. Using the life cycle cost analysis approach, LED signals were more cost effective than incandescent bulbs and comments were favorable that they were brighter. Red LED signals have already been implemented into MoDOT operations. Green LED signals will soon be used within the department as well. Yellow LED signals should be considered for use after ITE (Institute of Traffic Engineers) approval although the cost savings for yellow will be less since it is not as active as red and green.

Full text available at: http://168.166.124.22/RDT/reports/RI96023/RDT99010.pdf

Transport Canada Study: "LED Technology for Improved Conspicuity of Signal Lights at Highway-Railway Grade Crossings" (TP14043E)
Summary: "A review was conducted of the characteristics of light produced by red LEDs versus light produced by red-filtered incandescent bulbs. These characteristics were examined for how they would affect colour deficient individuals, drivers wearing sunglasses, aging eyes, visibility when drivers are subjected to a sun phantom effect, and visibility in fog. The review concluded that LED signal modules can be expected to outperform incandescent signals with the same luminous intensity because of two inherent advantages:

1. LED signals produce a pure red signal that is more conspicuous to the human eye.
2. LED signals can turn on and off instantaneously (as long as this characteristic is not compromised by the LED power supply), which improves the range at which flashing lights can be seen.

Accordingly, LED signals can be expected to provide an additional margin of conspicuity over incandescent light sources with the same luminous intensity."

Full text available at: http://www.tc.gc.ca/TDC/publication/pdf/14000/14043e.pdf

Item #2 -- RR crossings that intersect near a parallel roadway

National Transportation Safety Board, "Safety at Passive Grade Crossings"
Summary: "A nearby highway intersection may present a distraction to the driver simply because the driver is aware of it. If a highway intersection on the departure side of the crossing is visible to an approaching driver, the driver's attention may be drawn toward that intersection and away from the crossing. This may be particularly hazardous in urban areas, where the driver's concern for traffic at the upcoming intersection may result in stopping directly on the tracks, as was the case in Pickerington, Ohio.

In other situations, the driver of a vehicle turning off a parallel roadway may come upon the crossing before being able to direct attention away from negotiating the turn; at four study crossings, the highway intersection was less than 25 feet from the crossing (cases 1, 15, 44, and 58). In addition, if a train comes from the same direction as a highway vehicle on the parallel roadway, it will come from behind the vehicle, and a driver turning onto the road with the grade crossing may have few moments to react."

"If separation or closure is not possible, the next most desirable method to improve safety at passive crossings is to equip passive crossings with active devices that warn the motorist of an oncoming train."

Full text available at: http://www.ntsb.gov/Publictn/1998/SS9802.pdf

MoDOT Staff Findings (cont'd.)

Federal Highway Administration, "Highway Design Handbook for Older Drivers and Pedestrians"

Summary: "Other research pertaining to signing for highway-rail grade crossings for which data from older drivers has been obtained has addressed comprehension of the Railroad Advance Warning sign and the Parallel Railroad Advance Warning sign. Picha, Hawkins, and Womack (1995) conducted a survey of 747 drivers ranging in age from 16 to 65 and older who were renewing their drivers' licenses in seven Texas cities. Of the 747 participants 54 were ages 55 to 64 (7.3 percent of the sample) and 31 were age 65 or older (4.2 percent of the sample). A multiple choice question was included regarding the meaning of the W10-1 (Railroad Advance Warning) sign and the W10-3 (Parallel Railroad Advance Warning) sign. No advantages for alternative designs to the standard W10-1 were demonstrated in this research; however, an alternative to the current W10-3 was recommended.

The standard Parallel Railroad Advance Warning sign (W10-3) and three Alternative designs were shown to the same driver sample. (See figure 23.) Alternative 1 was a yellow diamond sign that consisted of the same elements present in the standard design, except that the roadway outline was drawn (as opposed to thick solid lines), and a bent right arrow was drawn within the roadway lines to indicate that a right turn would lead to railroad tracks. Alternative 2 was the standard W10-1 sign (Advance RR Crossing) with a supplemental plaque containing an arrow that pointed to the right. Alternative 3 was the same as Alternative 2 except the supplemental panel contained a bent right-pointing arrow. The correct response, "you will cross a railroad track if you turn right at the intersection," was provided by 84.1 percent of the participants who saw the standard sign; 88.1 percent of the respondents who saw Alternative 1; 90.5 percent of the respondents who saw Alternative 2; and 87.2 percent of the respondents who saw Alternative 3. A higher percentage of respondents indicated that they did not know what the standard sign meant (10.2 percent) than the alternative designs (6.2 percent for Alternative 1; 3.2 percent for Alternative 2; and 1.6 percent for Alternative 3). Thus, the standard W10-3 sign had the lowest correct response rate and the highest "not sure" rate, although these differences did not reach statistical significance. While suggestive, further work is deemed necessary to justify a recommendation in this Handbook."

Full text available at: http://www.tfhrc.gov/humanfac/01103/ch5.htm

Item #3 – Frequency of RR crossing deaths with unbelted drivers

No articles on this topic were found.